Refutation of Bell's theorem for temporal logic

Abstract: We evaluate Bell's theorem for temporal logic. It is *not* tautologous. Hence schematics of a protocol for a violation of Bell's inequalities for temporal order are similarly moot. These conjectures form a *non* tautologous fragment of the universal logic VŁ4.

We assume the method and apparatus of Meth8/VŁ4 with Tautology as the designated proof value, **F** as contradiction, N as truthity (non-contingency), and C as falsity (contingency). The 16-valued truth table is row-major and horizontal, or repeating fragments of 128-tables, sometimes with table counts, for more variables. (See ersatz-systems.com.)

LET ~ Not, ¬ ; + Or, ∨, ∪, ⊔ ; - Not Or; & And, ∧, ∩, ⊓ , · , ⊗ ; \ Not And;
> Imply, greater than, →, ⇒ , ↦, ≻, ⊃, ↠ ; < Not Imply, less than, ∈, ≺, ⊂, ⊬, ⊭, ↞, ≲ ;
= Equivalent, ≡, :=, ⇔, ↔, ≜, ≈, ≃ ; @ Not Equivalent, ≠, ⊕;
% possibility, for one or some, ∃, ◊, M; # necessity, for every or all, ∀, □, L;
(z=z) T as tautology, ⊤, ordinal 3; (z@z) **F** as contradiction, Ø, Null, ⊥ , zero;
(%z>#z) N as non-contingency, Δ, ordinal 1; (%z<#z) C as contingency, ∇, ordinal 2;
~(y < x) (x ≤ y), (x ⊆ y), (x ⊑ y); (A=B) (A~B).
Note for clarity, we usually distribute quantifiers onto each designated variable.

From: Zych, M.; Costa, F.; Pikovski, I.; Brukner, Č. (2019). Bell's theorem for temporal order. nature.com/articles/s41467-019-11579-x, arxiv.org/pdf/1708.00248.pdf m.zych@uq.edu.au

B. Bell’s theorem for temporal order The scenario for which the theorem is formulated involves a bipartite system ...

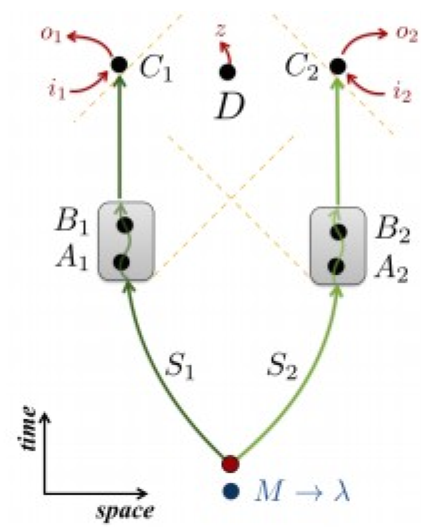

FIG. 2: Bell’s theorem for temporal order. A bipartite system, made of subsystems S_1 and S_2, is sent to two groups of agents. Operations on S_1 (S_2) are performed at events A_1, B_1 (A_2, B_2). At event C_1 (C_2), a measurement with setting i_1 (i_2) and outcome o_1 (o_2) is performed. Events A_1, B_1 are space-like separated from A_2, B_2[,] and C_1 is space-like to C_2; light cones are marked by dashed yellow lines. … The system M is measured at event D, producing an output bit z. If the initial state of the systems S_1, S_2, M is separable, and λ is a classical variable … , the resulting bipartite statistics of the outcomes o_1, o_2 cannot violate any Bell inequality, even if conditioned on z. (1.0)

LET p, q, r, s, t, u, v, w: A, B, C, S, D, i, o, z.

((s&(%s>#s))>(((p&(%s>#s))&(q&(%s>#s)))>((r&(%s>#s))>(((u&(%s>#s))>(v&(%s>#s)))>(t>z)))))=
((s&~(%s>#s))>(((p&~(%s>#s))&(q&~(%s>#s)))>((r&~(%s>#s))>(((u&~(%s>#s))>(v&~(%s>#s)))>(t>z))))) ;

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TTTT TTTT TTTT TTTT( 1)    }x4
TTTT TTTT TTTT TTTF( 1)    }
TTTT TTTT TTTT TTTT( 2)    }
TTTT TTTT TTTT TTTF( 1)}x3}
TTTT TTTT TTTT TTTT( 1)}   }
TTTT TTTT TTTT TTTT( 2)    }
TTTT TTTT TTTT TTTT( 1)}x2}
TTTT TTTT TTTT TTTF( 1)}   }
TTTT TTTT TTTT TTTT(64)
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(1.2)

Eq. 1.2 as rendered is *not* tautologous. Hence schematics of a protocol for a violation of Bell's inequalities for temporal order are similarly moot**.**